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## 'Creation of Life' Is More Slogan Than a Description

"CREATION of Life in the Test Tube" was the spectacular headline of a science news story that broke ten days ago. The occasion was a publication in the Proceedings of the National Academy of Sciences by Prof. Arthur Kornberg of Stanford's Department of Biochemistry and his colleagues, Drs. Mehran Goulian and Robert L. Sinsheimer. This reported their work on the "in vitro replication of the DNA of Phi-X-174," which is a simple virus containing only six genes.

It is just that simplicity that makes Phi-X-174 an attractive model system for genetic chemistry: higher animals, including man, would be some million times more complex. But even the simple virus has in it the imprint of eons of cosmic evolution, being one of an innumerable variety of DNA molecules that now populate the earth.

IT IS ONE of the delights of a scientific education to be able to assimilate the endless technicalities of this line of work and then appreciate the elegance and the grandeur of the thinking that went into it as well as the meticulous drudgery of preparing for the crucial experiments. The headline suggests a sudden breakthrough. In fact, Dr. Kornberg had consolidated the essential advances over 10 years with the extraction of the crucial enzyme, DNA replicase.

Since that time, the present accomplishment has been clearly in sight, though surprisingly elusive until some ancillary, but fatal, gaps in scientific understanding could be filled. One of the most important of these was the action of another enzyme, a DNA "ligase," which can heal small nicks in the growing DNA

strand and seal off the finishing touches on the complete molecule.

All told, the experimental replication of DNA stands as one of the outstanding intellectual edifices of the 20th century, quite apart from the philosophical and human impact of the accomplishment. Dr. Kornberg would, however, be the first to point out that "creation of life" is a slogan rather than a thoughtful characterization: "I really don't think my colleagues and I have ever discussed whether or not this is a living molecule that we have created." To many readers, however, "creation of life" carries such a load of emotional and theologian impact that this deserves to be clarified.

REPLICATION is an elegant way to say "copying." The propagation of life must provide for the copying of genetic information to pass similar copies to many offspring. The kernel of Dr. Kornberg's experiment was to conduct the copying of an existing virus DNA in the test tube under well-defined conditions.

This process has long been known to occur within the cell. The whole point of the experimental work is to understand how the replication process works, and this has now been corroborated by being emulated in the test tube with materials extracted and purified from cells.

The leap in understanding is comparable to man's discovery that wheat could be "created" by planting the right seed in the ground. But now our understanding is at a molecular level, almost as far as human thought can be expected to reach and one that does show new ways to modify the genetic process.

If, through our under-

standing of DNA chemistry, we "create" new kinds of DNA molecules, we then have very powerful new tools for designing new viruses and other organisms which could be of enormous value in fighting the scourges of life. Before we react reflexly to the idea of "tampering with genes," we ought to remember that the history of human civilization runs parallel with unremitting effort at controlling biological evolution in the guise of the domestication of crop plants, animals and, in a sense, man himself.

It is in this century that we have lost the comfort of blind ignorance: we are beginning to use our intelligence to understand what we are doing.